A Bean Named Soy

Grade Level: 4-6

Approximate Length of Activity: One class period

Objectives:

Teacher:

1. Educate students about plant growth, and more specifically, soybean plants.
2. Help students become aware of the importance of soybeans.
3. Provide students with materials to make soynuts.
4. Help students understand the parts of a soybean seed and the soybean plant.
5. Teach students how soybeans are processed and used in foods.

Students:

1. Learn about soybeans, the parts of the soybean seed and plant, and plant growth.
2. Understand how the soybean is processed and used in foods.
3. Use math skills (multiplication and percentage) to answer questions about soybeans.

Michigan Content Standards: (Science) I.1.4; III.2.4; III.2.5; IV.1.3; V.1.5

Introduction:

Many things in nature help regulate the growth of a plant, the soil, its nutrients, air, water, climate, temperature, and light. These are known as environmental factors. Plants need nutrients to grow and water to move these nutrients to the different parts of the plant.

Most plants have chlorophyll, the green coloring in plants that uses the energy from light to manufacture sugar ($C_6H_{12}O_6$). This sugar and other carbohydrates formed are used as food to enable the plant to grow. This process is called photosynthesis. Plants grown in the dark lose their chlorophyll and green coloring. Without light and chlorophyll, the plant is unable to make sugar. This slows plant growth and can cause the plant to die. When the soil loses nutrients and plants can no longer grow properly, fertilizer can provide the nutrients needed for the plant to grow.

Soybeans are called " The Miracle Seed" because they are used for human food, consumer and industrial products, and livestock feed. Soybeans are one of the nation's most fascinating and versatile edible plants. In 2001, Michigan farmers harvested 2.1 million acres of soybeans. These 2,100,000 acres produced 75,600,000 (75.6 million) bushels of soybeans.

One bushel of soybeans, which weighs 60 pounds, produces 11 pounds of soybean oil. About 90 percent of this oil is used in the preparation of food products. The remaining 10 percent is used in consumer and in industrial products. Soy inks, plastics, biodiesel fuels, and biocomposite building materials are a few of the industrial uses that have been developed using soybean oil, in place of petroleum. Scientists and researchers continue to work and replace petroleum with soybean oil in many other products and to create new uses for soybeans.

Each year's soybean crop develops from soybean seeds. The soybean seed contain a seedling (young plant) and food for it.

The main parts of the soybean seed are:

Hilum- The part of the seed attached to the pod. The hilum is often black or brown, but yellow on some varieties.
Seed Coat- A thin covering that protects the seed's embryo from insects, disease, and damage.
Cotyledon- The part of the seed that stores food for the seedling. Each bean has a pair of cotyledons forming a protective shield around the seedling.
Epicotyl- The part of the plant that grows. The stem forms and grows from this point.
Hypocotyl- Forms the stem below the cotyledon
Radicle- The main (primary) root of the seedling. It takes up water and nutrients from the soil to nourish the seedling.

After soybeans are harvested, they are sold to a grain elevator, fed to livestock, or stores in a grain bin until they are sold. When soybeans are sold, they are taken to processing plants or exported.

In processing, the soybeans are cleaned, cracked, dehulled, and rolled into flakes. The hulls (outer covering) are used as additives for breads, cereals, and snacks. Then the oil is removed from the soybean and the remaining soybean flakes are processed into various edible soy protein products. Soybean oil finds its way into such products as margarine, salad, and cooking oils.

Lecithin, extracted from the soybean oil, is used for everything from pharmaceuticals to protective coverings. It is a natural emulsifier and lubricant. Lecithin keeps chocolate and cocoa butter in a candy bar from separating.

Materials Needed:

- "Figuratively Speaking" worksheet
- "Development of the Soybean" handout
- "Main Parts of the Soybean Seed" handout
- 1 cup of soybeans for each student
- 2 tsp. Baking soda for each student
- 4 cups water for each student (plus water for soaking the soybeans)
- Salt (1 teaspoon for each quart of water used to soak the soybeans)

Activity Outline:

1. Discuss soybean production and plant parts using the information in the introduction, "Development of the Soybean Plant" handout, and the "Main Parts of the Soybean Seed" handout.
2. Make soynuts as a class.
    a. Soak the soybeans in water overnight in the refrigerator. Add one teaspoon of salt to each quart of water used before adding the soybeans to the water.
    b. Boil one hour in the same water.
    c. Drain and air-dry the boiled soybeans.
    d. Spread in a single layer in a shallow pan.
    e. Roast in 350F oven for 30 minutes. Stir the soybeans after 15 minutes, then stir every five minutes until golden brown and crunchy.
    f. Eat the soybeans!
3. Ask students to complete the "Figuratively Speaking" worksheet. This worksheet is an exercise, which uses percentages and multiplication to solve questions about soybeans.

Discussion Questions:

1. Have you ever eaten a soybean? If so, what was it like?
2. What does a plant need to grow and survive?
3. What part of the seed stores food for the embryo?
4. What do we call the point of attachment between the seed and the pod?
5. What is the function of the seed coat?
6. What is the growing point of the plant forming the stem?
7. What are some products made from soybeans?
8. How is the soybean seed processed to use in foods?

Related Activities:

1. The lesson "WHERE WOULD WE BE WITHOUT SEEDS?" located in the Science section of Farm Bureau's Ag In the Classroom Lessons.
2. The lesson "FOOD AND FIBER PRODUCTS - HELPING THE ENVIRONMENT AND YOU" located in the Science section of Farm Bureau's Ag In the Classroom Lessons.
3. Visit a grain elevator or farm where soybeans are grown. Write a description of the visit.
4. Use soybeans to create an art project.
5. Bring in labels showing soybeans or soybean by-products used in an item.
6. Make a bulletin board of soybean products.
7. Share food made from soybeans in the classroom.
8. Discuss how the soybean evolved, and why it is still important in the field of agriculture.

Other Resources:

1. “The Soybean Solution,” Nebraska Soybean Association, 301 Centennial Mall So., Fourth Floor, Box 95144, Lincoln, NE 68509.
2. *Why the Brown Bean was Blue* by Susan M. Pankey, Nebraska Ag in the Classroom, 5225 S. 16th St., Lincoln, NE 68512, (402) 421-4400
3. “Where’s Bennie?” Coloring Book, Indiana Soybean Development Council, 423 West South St., Lebanon, Indiana, 46052, (317) 482-4376
4. Ag in the Classroom Video/Lesson Plans on Soybeans featuring “Sandy Soybean,” North Carolina Farm Bureau & North Carolina Soybean Producers Association, P.O. Box 27755, Raleigh, NC 27611, (919) 783-4326 or (919) 782-1705
5. “Soy McCoy Coloring Book,” Ohio Soybean Council, P.O. Box 479, Columbus, Ohio 43216
6. “The Magic Bean: A Look at the Versatile Soybean,” “Look Where Soybeans Go,” brochures from Archer Daniels, Midland Company, Box 1470, Decatur, Illinois 62525, (217) 424-520, http://www.admworld.com
7. “1995 Soy Stats,” a reference guide, American Soybean Association, P.O. Box 419200, St. Louis, MO 63141-9200, (314) 576-1770.
8. Michigan Soybean Association: www.michigansoybean.org.
9. American Soybean Association: www.oilseeds.org/asa/.
10. Soybean Statistics: www.ag.uiuc.edu/`stratsoy/96soystats/pg2.html.

To be used with:
A Bean Named Soy **Name** _____

"Figuratively Speaking"

An average bushel of soybeans weighs 60 pounds. Of each bushel, 80 percent becomes soybean mean and 20 percent is processed as soy oil.

1. How many pounds of soybean meal are produced from each bushel?

2. How many pounds of oil are produced from the same bushel?

3. If one pound of soy oil will fill a one-quart bottle half full, how many quarts of oil will be produced by a single bushel?

4. Eddie and Jodi sold 430 eight-ounce bags of soynuts at $.75 per bag before the basketball game. How many pounds of roasted soynuts were sold? (hint: 16 oz. = one lb.)

5. How much money did Eddie and Jodi make from selling the soynuts?

6. How much would 50 bushels of soybeans weigh?

7. How many pounds of soybean meal would come from 50 bushels of soybeans?

8. How many pounds of soybean oil would come from 50 bushels of soybeans?

9. An acre produces about 38.5 bushels of soybeans. How much would 38.5 bushels of soybeans weigh?

To be used with:
A Bean Named Soy **Answer Key**

"Figuratively Speaking"

An average bushel of soybeans weighs 60 pounds. Of each bushel, 80 percent becomes soybean mean and 20 percent is processed as soy oil.

1. How many pounds of soybean meal are produced from each bushel?

   48 pounds (60 x .80)

2. How many pounds of oil are produced from the same bushel?

   12 pounds (60 x .20)

3. If one pound of soy oil will fill a one-quart bottle half full, how many quarts of oil will be produced by a single bushel?

   6 quarts (12 ÷ 2)

4. Eddie and Jodi sold 430 eight-ounce bags of soynuts at $.75 per bag before the basketball game. How many pounds of roasted soynuts were sold? (hint: 16 oz. = one lb.)

   215 pounds (430 ÷ 2)

5. How much money did Eddie and Jodi make from selling the soynuts?

   $322.50 (430 x .75)

6. How much would 50 bushels of soybeans weigh?

   3,000 pounds (60 x 50)

7. How many pounds of soybean meal would come from 50 bushels of soybeans?

   2,400 pounds (48 x 50)

8. How many pounds of soybean oil would come from 50 bushels of soybeans?

   600 pounds (12 x 50)

9. An acre produces about 38.5 bushels of soybeans. How much would 38.5 bushels of soybeans weigh?

   2,310 pounds (38.5 x 60)

10. How many bushels of soybeans would be produced on 200 acres?

    7,700 bushels (200 x 38.5)

To be used with:
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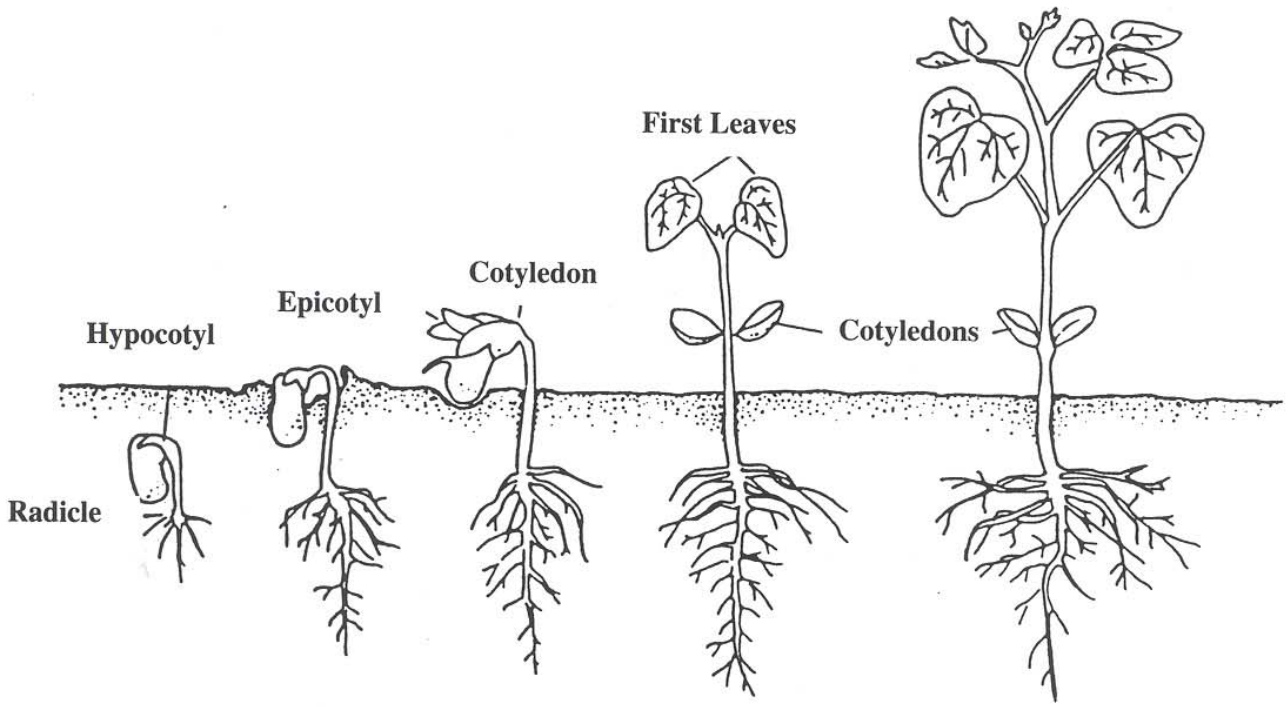
Name _____

Development of the Soybean Plant



To be used with:
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Name _____

Main Parts of the Soybean Seed

Hilum - point of attachment between seed and pod.

Hypocotyl - forms the stem below the cotyledon.

Epicotyl - growing point of plant, and forms the stem of the plant.

Cotyledon - stores food for embryo plant.

Radicle - forms the primary root.

Seed Coat - protects embryo from insects, disease, and damage.